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Does the Relationship between Motivation and Performance Differ with Ability?

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In this study of college students taking a science test or a social science test under non-consequential conditions, performance was positively correlated with self-reported motivation. The association, though, was smaller for students of lower ability (as measured by the SAT).

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The objective of this study was to explore how the relationship between test-taking motivation and performance might depend on ability. The literature suggests motivation and performance are associated. Combining findings from 232 samples, Uguroglo and Walberg (1979) found an average correlation between motivation and achievement (both test scores and course grades) of .34. However, motivation was rather broadly defined, including measures of self-concept and locus of control, and it was not necessarily test-specific motivation. Several studies, where motivation was manipulated (either by design or through a serendipitous policy change) by attaching consequences to one test compared to a test with no consequences, have shown increased performance under consequential conditions (Burke, 1991; Jennings, 1953; Rothe, 1947; Taylor & White, 1981; Wolf & Smith, 1995; Wolf, Smith, & DiPaolo, 1996). Wolf and Smith (1995) and Wolf, Smith, and DiPaolo (1996) also recorded considerably higher motivation scores (a difference of about 1.5 standard deviations) in these consequential compared to non-consequential test conditions, suggesting that the consequences increased scores because they motivated test-takers. When motivation increases though, anxiety may increase as well. This could decrease test performance, because highly anxious students tend to score lower on tests (Crooks, 1988; Hembree, 1988; Wolf & Smith, 1995; Wolf, Smith, & DiPaolo, 1996). As noted in the studies described above though, on average higher consequences lead to higher test scores. For the majority of students, then, it appears that the motivating effects of consequences are stronger than the anxiety-provoking effects.

None of these studies looked at how test motivation, or performance under motivating conditions, is related to ability. Individuals are not equally influenced by a given "motivation". Some students will find the consequential condition more motivating than others, and some students who find the consequences motivating may become more anxious or for whatever reason perform more poorly in this situation. In Wolf and Smith's (1995) sample, about 1/3 of students scored higher under no consequences. Some of the individual differences may be due to ability as well as the specific conditions. For example, students with generally low abilities may believe that effort is futile, especially if there is

some "cut-score" above their ability and increased scores below that mark will do little good. Anxiety may also play a bigger role for these students, who have generally negative experiences with testing. Students with generally high abilities, on the other hand, may have generally positive feelings toward testing which are not greatly influenced by the test condition. They also might not perceive negative consequences as a likely threat, because they are likely to do well on the test.

The research questions guiding this study were:

1) Are motivation scores correlated with ability?

2) Are the effects of motivation on performance the same across the ability distribution?

Methods

Participants

Students at James Madison University (JMU) participate in an Assessment Day before the fall semester of their first year and another during the spring semester of their sophomore year. A variety of tests assessing the JMU General Education program and student development are administered each year; students are randomly assigned to take several of the tests in a 3 hour session. For this study, data was used from 249 students who took the Natural World test in February 1998 and 473 students who took the Global Experiences test in February 1999. The Natural World test is a multiple-choice test which assesses students' abilities to use mathematics and science to understand the natural world and society. The Global Experiences test is a social science test, including multiple choice items about sociology, economics, political science, and geography. Students were told that their responses would provide important information for evaluating the university's programs. While the instructions were intended to motivate students to perform their best, there were no individual consequences for poor or good performance.

A short survey, developed by Wolf and Smith (1995), was used to measure student motivation during testing. Students responded to eight items (about the importance of the test and their effort), each

on a 5-point Likert scale. This survey was administered at the end of the testing session. It was presented to students as the Student Opinion Survey (SOS).

SAT data were available from admissions records. The Verbal and Math scales were used as measures of general ability.

Results

Motivation and ability were not correlated (r = -.03 for motivation and SAT for Natural World and r = .-.04 for Global Experience). Motivation had a low-moderate correlation with test performance (r = .29 for Natural World and r = .22 for Global Experience). SAT scores were somewhat more correlated with test performance than motivation was (r = .52 for the combined SAT score and Natural World score, and r = .47 for combined SAT and Global Experience score).

When motivation and SAT combined score (Verbal + Math) were used to predict test scores through multiple regression, both were significant predictors while controlling the other ($p < .0001$, see Table 1 for parameter estimates). For the Natural World test, the interaction between motivation and SAT combined score, when added to the model, was statistically significant (see Table 2). The effects of motivation and ability on Natural World scores, then, depended on each other. For the Global Experience test, though, the interaction did not account for any significant variance, controlling the main effects.

Table 1

Test Scores predicted from Motivation and SAT

Natural World Source	df	$\hat{\beta}$	SE of $\hat{\beta}$	T	p-value
Intercept	1	-7.57	5.72	-1.323	0.1871
Motivation	1	0.48	0.08	5.972	0.0001
SAT	1	4.64	0.45	10.256	0.0001
Global Experiences					
Source	df	$\hat{\beta}$	SE of $\hat{\beta}$	T	p-value
Intercept	1	-6.40	1.92	-3.337	0.0009
Motivation	1	0.15	0.03	6.013	0.0001
SAT	1	1.76	0.14	12.214	0.0001

Table 2

Test Score Predicted from Motivation, SAT, and the Interaction

Natural World Source	df	$\hat{\beta}$	SE of $\hat{\beta}$	T	p-value
Intercept	1	49.58	23.29	2.128	0.0343
Motivation	1	-1.98	0.978	-2.025	0.0439
SAT	1	-0.20	1.96	-0.101	0.9195
Interaction of Motivation and SAT	1	0.21	0.08	2.529	0.0121
Global Experience **Source**	**df**	$\hat{\beta}$	**SE of $\hat{\beta}$**	**T**	**p-value**
Intercept	1	-2.91	9.57	-0.304	0.7609
Motivation	1	0.04	0.29	0.149	0.8817
SAT	1	1.47	0.80	1.848	0.0652
Interaction of Motivation and SAT	1	0.01	0.02	0.373	0.7097

To illustrate the relationship between motivation and performance on the Natural World test, students were divided into three approximately equal-sized groups based on their SAT scores, and separate regression equations for motivation and natural world scores were calculated for each group (note that the standard errors of the slopes are larger due to the decreased sample size). Figure 1 shows the Natural World scores predicted from motivation scores. The influence of motivation was somewhat less for those of low ability; increased motivation did not increase their test scores as much as a comparable increase in motivation increased test scores for those in the high ability group. This analysis was repeated for the Global Experiences test (Figure 2); even though the interaction was not significant, the graph shows a similar pattern as for the Natural World test.

Discussion and Implications

In this study, motivation was not correlated with ability (research question 1), but the relationship between motivation and performance depended on ability, at least for the Natural World test (research question 2). If there had been a strong correlation between motivation and ability, there would be reason to suspect that the relationship between motivation and performance might be spurious, actually due to

ability's relationships with both motivation and performance, but this was not the case. The interaction between ability and motivation, though, suggests that conclusions about the overall effects of motivation do not apply to all ability levels equally. However, this interaction is an ordinal one (motivation increases performance at all ability levels, but especially so for high ability students), so some generalizations about the effects of motivation can be made reasonably.

One limitation to this study was that the "extreme" ability groups were not that extreme. Because the overall sample size was not large, ability groups of approximately equal size were used. It would be interesting to estimate the effects of motivation in the top 5% (students who might almost always do well on tests regardless of their motivation) and the bottom 5% (students who might have limited success even when highly motivated) as well, if much larger samples were available.

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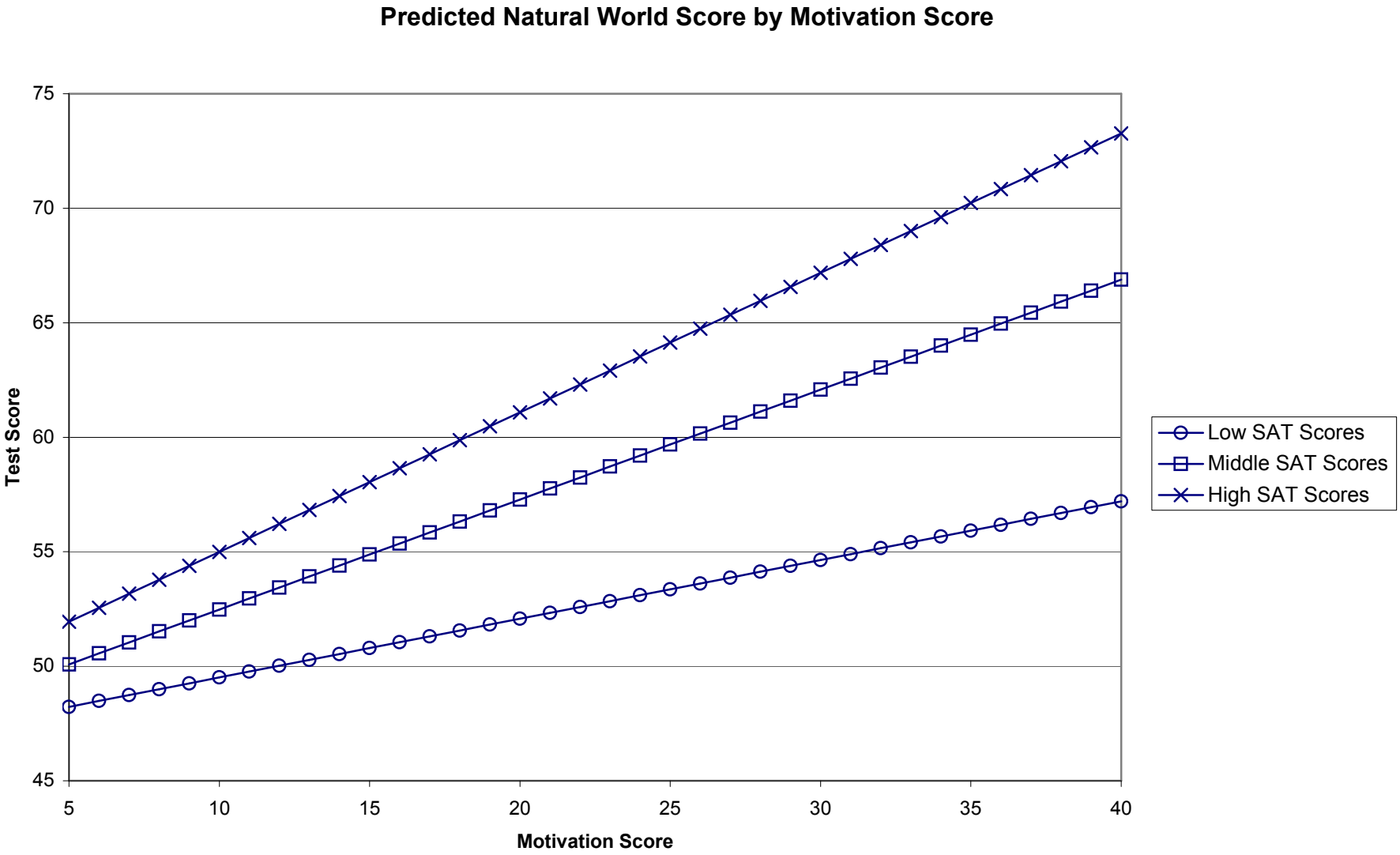

Figure 1. Separate regression equations were estimated for three ability groups.

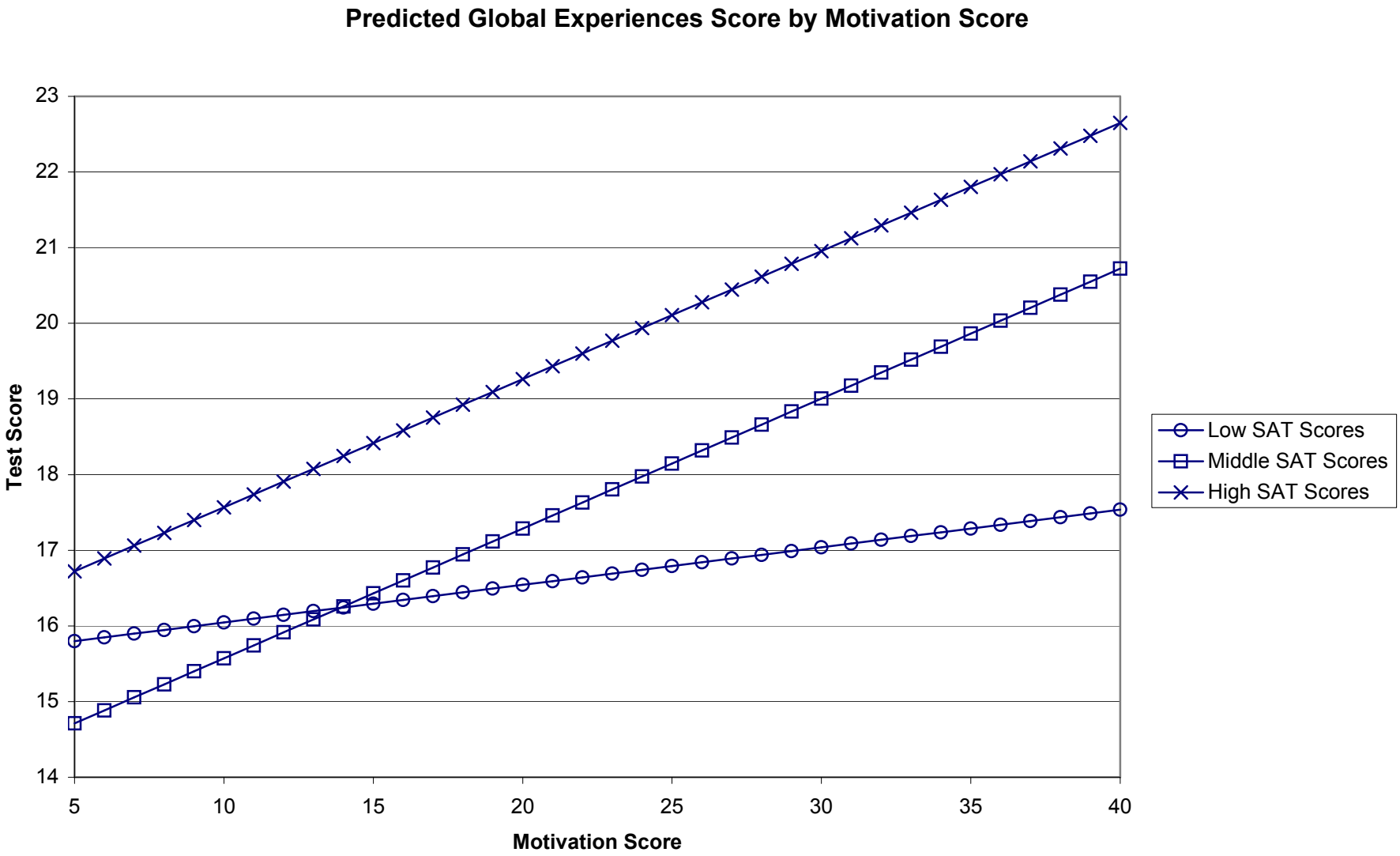

Figure 2. Separate regression equations were estimated for three ability groups.